RESEARCH ARTICLE.........

The effects of different treatments of pre-milking manual tactile teat stimulation on day-to-day variation in milk yield, milk components, main milking phase, total milking time and average milk flow rate in crossbred cattle

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ABSTRACT...... The present study was carried out to investigate the effect of different treatments of udder stimulation on day to day variations in milk parameters in cross bred cows. In group T_1, milk yield was positively (P<0.01) correlated with main milking phase, total milking time and average milk flow rate. Milking duration was significantly (P<0.01) correlated with total milking time and average milk flow rate. Total milking time was showed positive (P<0.01) correlation with average milk flow rate. Fat percentage had positive (P<0.05) correlation with SNF (r=0.46). Significantly (P<0.05) positive correlation was observed between total solids with lactose and ash content. SNF was significantly (P<0.05) correlated with acidity. Specific gravity was positively (r=0.59) correlated with total solids.In T_2, milk yield was significantly (P<0.01) correlated with main milking phase, total milking time, average milk flow rate (r= 0.99) and negatively (P<0.05) correlated with fat percentage. Main milking phase had positive correlation with total milking time and average milk flow rate and negative correlation with fat percentage. Total milking time was significantly correlated with average milk flow rate. Average milk flow rate had negative correlation with fat percentage (r=-0.71). In T_3, milk yield was significantly correlated with main milking phase, total milking time and average milk flow rate and negatively with fat percentage (r=-0.55). Total milking time and average milk flow rate were positively correlated with main milking phase and milking duration was negatively correlated with fat percentage (r=-0.54). Total milking time was positively correlated with average milk flow rate and negatively correlated with fat. Fat percentage was negatively correlated with average milk flow rate was with. Ash content and acidity were positively correlated with total solids.

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INTRODUCTION...

Milkability can be classified into the so called "functional traits of cattle". Functional traits can be described as the attributes which influence the production and the economy of rearing by decreasing of input costs and dairy farmers place considerable emphasis on milkability, because slow milking cows are hindering the milking process of the herd, especially in milking parlours (Antalik and Strapak, 2011).At auctions, where daily milk yield as well as milkability of freshly calved heifers is announced, milkability had a significant impact on the price (Krogmeier *et al.,* 2006).

Improving milk production remains a challenge for tropical and developing countries. Several studies have been done on zebu cattle with the ambition of increasing milk production by improved feeding and management (Coulibaly and Nialibouli, 1998; Bonfoh *et al.,* 2005 and Sidibe- Anago *et al.,* 2006). An important management tool in dairy production is milk recording based on knowledge about the relative day-to-day variation in milk yield and composition (Millogo *et al.,* 2009).The relative day-to-day variation in milk yield and milk composition for machine-milked dairy cows has been estimated to be about 6-8 per cent for yield, 5-8 per cent for fat content, 1.5 - 2 per cent for protein content and just above 1 per cent for lactose (Syrstad, 1977 and Sjaunja, 1986). The degree of udder emptying also has a strong effect on milk fat content since fat content increases during milking (Johansson *et al*., 1952). Protein content is less variable than fat content and lactose is the most constant constituent due to its osmotic regulatory effect (Svennersten-Sjaunja *et al*., 1997). The day-to-day variation in milk somatic cell count (SCC) has been estimated to be on average 9 per cent for healthy cows and 7 per cent for mastitic cows (Sjaunja, 1986). Day-to-day variation is mainly described in dairy cows in machine-milking systems; there is a lack of information about other species and hand-milking systems. It is also important to know differences in day to day variation in milk composition because when data from cows is used to estimate nutrition needs and for breeding purposes the samples are often collected from one day per month and can also differ between morning and evening milkings. If the milk composition varies a lot over days, and within days, it could lead to miscalculations (Syrstad, 1977). Study of milk flow during milking can provide useful information for enhancing the efficiency of milking process, avoiding some common mistakes and protecting teat integrity and udder health. Proper milking routine should provide unstressful environment for the cow and ensure that the premilking teat preparation is performed in the same sequence of events to result in complete milk ejection before the milking starts and to minimize the amount of milk that should be removed by stripping.

In order to improve dairy production in developing countries, basic information about variation in milk production is necessary and this knowledge of factors contributing to variation in milk composition is important as it will enable increased efficiency of experimental design, and will identify opportunities for manipulating the composition of milk protein to improve the yield and quality of milk products.

RESEARCH METHODS......................................

The present experiment was conducted in dairy farm of Sam Higgnibottom Institute of Agriculture, Technology and Sciences, Allahabad. All crossbred cows were subjected to Californian Mastitis Test (CMT) and positive reactors were discarded. Twelve apparently healthy crossbred cows free from any noticeable injuries on udder and kept under similar management condition were randomly selected. Sanitary measures like clipping of long hair on the udder and flank, cleaning of dairy barns, washing of udder and teats with clean water before milking were adopted. All animals were maintained under scientific tail to tail feeding and management system. Cows were milked by dry full hand diagonal method of milking (Singh and Prasad, 1987).

Three different treatment groups (4 cows in each group) for experiment were as follows:

T_1: Udder of cows stimulated for one minute before milking.

T_2: Udder of cows stimulated for two minutes before milking.

T_3: Udder of cows stimulated for three minutes before milking.

Cows were milked by full hand method of milking. Milk yield of experimental animals was recorded also main milking phase time by means of stopwatch (Actual time require for milking), total milking time(Treatment + Actual milking time), average milk flow rate calculated based on observation noted and representative sample of 200 ml milk was collected directly into sterilized conical flasks of 250 ml capacity and cotton plugs were replaced

immediately. Samples were brought to the laboratory for determination of per cent fat, protein, lactose, ash, solid not fat (SNF), acidity and specific gravity. Fat per cent was determined by using Gerber method as per IS: (1224) (Part-I) 1977. Protein per cent was determined by formal titration method described by (Korprich, 1946). Lactose per cent was determined according to method stated by Barnett and Nawab (1957) and Marier and Boulet (1959). Total ash per cent of milk samples was estimated as per the procedure recommended by BIS IS: (7874) (Part-I) 1976. Solids Not Fat (SNF) was determined by Richmond's formula. TS per cent was determined by gravimetric method as per IS: (1479) (Part-II) 1996. Lactometer was used for determination of specific gravity (Murphy and Boor, 2000). Acidity was determined as per (AOAC, 2005).

Statistical analysis :

Data were statistically analyzed by one-way ANOVA and results were expressed as mean ± SE. Means were compared using Tukey's multiple comparisons test. The statistical package of Graph pad prism, San Diego, USA was used for analyzing the data.

RESEARCH FINDINGS AND ANALYSIS...........

The average of effect of different treatments of udder stimulation on milk parameters and their day to day variation in cross bred cows are presented in Table 1 and 2, respectively. The correlation among day to day variation in milk parameters in treatment group T_1 is presented in Table 3. Milk yield was significantly (P<0.01) positive correlated with main milking phase, total milking time and average milk flow rate (r= 0.99). Main milking phase was significantly (P<0.01) correlated with total milking time and average milk flow rate. Total milking time was significantly (P<0.01) correlated with average milk flow rate (r= 0.99). Fat percentage was positively (P<0.05) correlated with SNF (r=0.46). Total solids was significantly (P<0.05) correlated with Lactose (r=0.63) and ash content (r=0.55). SNF was significantly (P<0.05) correlated with acidity. Specific gravity was positively (r=0.59) correlated with total solids.

The correlation among day to day variation in milk parameters in treatment group T_2 is presented in Table 4. Milk yield was significantly (P<0.01) positive correlated with main milking phase, total milking time, average milk flow rate (r= 0.99) and negatively correlated with fat percentage. Main milking phase was positively (P<0.01) correlated with total milking time and average milk flow rate and negatively correlated with fat percentage. Total milking time was significantly correlated with average milk flow rate (r= 0.99). Average milk flow rate was negatively correlated with fat percentage (r=-0.71).

The correlation among day to day variation in milk parameters in treatment group T_3 is presented in Table 5. Milk yield was significantly (P<0.01) correlated with Main milking phase, total milking time and average milk flow rate (r= 0.99) and negatively correlated with fat percentage (r=-0.55).Main milking phase was positively correlated with total milking time and average milk flow rate and negatively correlated with fat percentage (r=-

Table 1 : Effect of different treatments of udder stimulation on milk parameters in cross bred cows groups			
	T_1	T_2	T_3
Milk yield (kg/day)	4.45±0.23[b]	5.19±0.22[a]	3.11±0.21[c]
Main Milking phase(min)	2±0.10[b]	2.33±0.10[a]	1.4±0.09[c]
Total milking time (min)	3±0.10[b]	4.33±0.10[a]	4.40±0.0[a]
Average milk flow rate kg/min	1.48±0.02[a]	1.20±0.02[b]	0.71±0.03[c]
Fat (%)	4.11±0.15[a]	3.59±0.12[b]	4.12±0.20[a]
Protein	3.28±0.03[b]	3.34±0.02[a]	3.37±0.03[a]
Lactose	4.77±0.04	4.78±0.06	4.70±0.04
Ash	0.68±0.00	0.68±0.00	0.67±0.00
SNF	8.61±0.1[a]	8.5±0.09[b]	8.5±0.07[b]
Total solids	12.51±0.15	12.84±0.27	12.39±0.09
Acidity	0.13±0.00	0.14±0.00	0.14±0.00
Specific gravity	1.03±0.00	1.03±0.00	1.03±0.00

Means bearing superscripts in lower case letter in row differ significantly (P<0.05)

Table 2: Effect of different treatments of udder stimulation on day to day variations in milk parameters in cross bred cows

	T₁	T₂	T₃
MY	-0.01±0.20	-0.01±0.20	0.01±0.20
MMP	-0.01±0.09	-0.01±0.12	0.00±0.12
TMT	-0.00±0.09	-0.00±0.12	0.00±0.12
AMFR	-0.00±0.02	-0.00±0.03	0.00±0.04
F	-0.01±0.16	0.00±0.13	0.01±0.25
P	0.00±0.05	0.00±0.03	0.01±0.04
L	-0.01±0.06	0.00±0.05	0.01±0.07
A	0.00±0.01	0.00±0.01	0.00±0.02
SNF	0.00±0.14	0.01±0.12	0.00±0.10
TS	-0.02±0.19	-0.04±0.40	-0.01±0.14
AD	0.00±0.01	0.00±0.00	0.00±0.00
SG	0.00±0.00	0.00±0.00	0.00±0.00

MY=Milk yield (kg/day); MMP= Mainmilking phase (min); TMT= Total milking time (min); AMFR= Average milk flow rate kg/min; F=Fat (%); TS=Total solids; P= Protein; L=Lactose; A=Ash; AD =Acidity; SG= Specific gravity

Table 3 : Correlation among day to day variation in milk parameters in treatment group T₁

	MY	MMP	TMT	AMFR	FAT	P	L	A	SNF	TS	AD
MY											
MMP	0.99**										
TMT	0.99**	0.99**									
AMFR	0.99**	0.99**	0.99**								
FAT	-0.13	-0.12	-0.14	-0.13							
P	0.01	0.00	0.01	0.01	-0.40						
L	-0.00	0.00	0.00	-0.01	-0.01	-0.48					
A	-0.08	-0.07	-0.09	-0.09	0.26	-0.00	0.27				
SNF	0.17	0.18	0.18	0.19	0.46*	-0.12	-0.08	0.06			
TS	0.08	0.10	0.10	0.08	-0.04	-0.24	0.63*	0.55*	0.16		
AD	0.22	0.23	0.22	0.21	0.34	-0.17	-0.30	-0.07	0.66*	-0.03	
SG	0.14	0.16	0.15	0.15	-0.06	-0.40	0.35	0.00	0.11	0.59*	0.22

* and ** indicate significance of values at P < 0.05 and 0.01, respectively

Table 4: Correlation among day to day variation in milk parameters in treatment group T₂

	MY	MMP	TMT	AMFR	FAT	P	L	A	SNF	TS	A
MY											
MMP	0.99**										
TMT	0.99**	0.99**									
AMFR	0.99**	0.99**	0.99**								
FAT	-0.71*	-0.72*	-0.70	-0.71*							
P	0.12	0.12	0.12	0.11	-0.06						
L	0.09	0.10	0.08	0.09	-0.15	-0.43					
A	0.37	0.37	0.37	0.37	-0.10	-0.37	0.39				
SNF	-0.23	-0.24	-0.23	-0.22	0.23	-0.30	-0.06	0.08			
TS	-0.18	-0.19	-0.18	-0.20	-0.07	0.20	-0.33	-0.41	-0.05		
AD	-0.34	-0.33	-0.34	-0.35	0.28	-0.32	0.31	-0.06	0.05	0.16	
SG	-0.04	-0.03	-0.04	-0.03	-0.13	-0.17	0.15	-0.16	-0.31	-0.31	0.00

* and ** indicate significance of values at P< 0.05 and 0.01, respectively

Table 5: Correlation among day to day variation in milk parameters in treatment group T$_3$

	MY	MMP	TMT	AMFR	FAT	P	L	A	SNF	TS	AD
MY											
MMP	0.99**										
TMT	0.99**	0.99**									
AMFR	0.99**	0.99**	0.99**								
FAT	-0.55*	-0.54*	-0.55*	-0.54*							
P	0.08	0.07	0.09	0.07	-0.05						
L	-0.18	-0.18	-0.16	-0.16	0.18	0.10					
A	-0.169	-0.16	-0.16	-0.16	0.23	0.25	0.35				
SNF	0.42	0.41	0.42	0.42	-0.30	-0.08	0.04	-0.10			
TS	0.16	0.17	0.15	0.14	-0.29	0.33	-0.10	0.57*	-0.20		
AD	0.12	0.11	0.11	0.11	-0.13	0.09	-0.01	0.38	0.17	0.49*	
SG	-0.29	-0.27	-0.29	-0.28	0.49	-0.44	-0.18	-0.25	0.28	-0.51	-0.16

* and ** indicate significance of values at P<0.05 and 0.01, respectively

0.54). Total milking time was positively (r=0.99) correlated with average milk flow rate and negatively correlated with fat (r=-0.55). Average milk flow rate was negatively correlated with fat percentage (r=-0.54). Total solids were positively (P<0.05) correlated with ash content and acidity.

Conclusion :

It was concluded that milk yield was better when udder was stimulated for two minutes before milking. Per cent fat and SNF were better when udder was stimulated either for one minute or three minutes before milking as compared to two minutes udder stimulation. For better milk yield, pre-milking udder stimulation for two minutes is recommended. For better percentage of fat or SNF, it is better to stimulate udder for one minute. Udder stimulation had no effect on acidity and specific gravity in crossbred cows under study.

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